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(54) Washing machine with weight detection means and out-of-balance detection means.

(57) In a washing machine having a spin sequence in the program, there is provided weight responsive means such as a transducer located in a mounting block (27) responsive to the weight of the contents of the drum (16) and adaptable to respond to the degree of out-of-balance of the drum contents, together with a control system for controlling the speed rotation of the motor (17) during the spin sequence in accordance with the degree of out-of-balance sensed by the weight -responsive means.

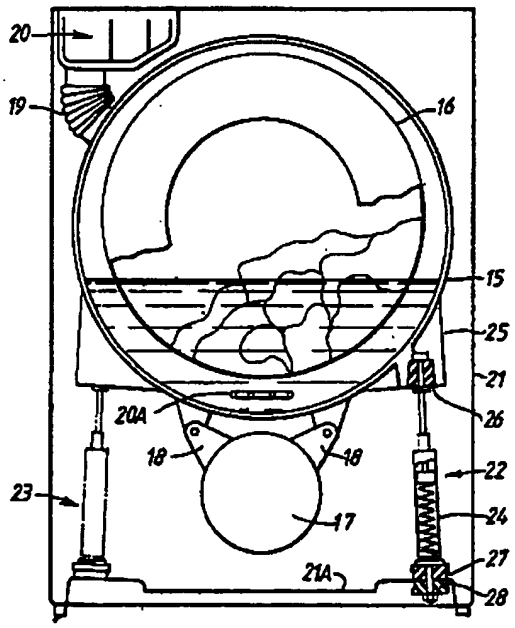

FIG.2.

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Improvements in or relating to Washing Machines

This invention relates to washing machines and has particular reference to automatic washing machines that are preset by a user to cycle through pre-arranged programs, some at least of which include a spin sequence as part of the program.

A difficulty arises in connection with those programs that include a spin sequence.

In order to limit the loading of certain critical components of such equipment to ensure that the components have an acceptable working life, it is usual to select the speed of rotation at which spinning takes place to a value ensuring that working life. However, high spin speeds are desirable because at such speeds a higher proportion of moisture can be extracted than is the case with presently used speeds.

It is possible to use high spin speeds by increasing the ability of the components to withstand such higher forces as result from the higher spin speeds but this is expensive and it limits the extent to which it is possible to standardise components for a range of equipment.

The loading of the components is determined in part by the degree of "out-of-balance" of the rotating parts and it has been suggested that means be incorporated which respond to an excessive out-of-balance and stop the rotation of the drum. Excessive in this context is that degree of out-of-balance which will cause unacceptable movement of the machine or internal parts of the machine during the early part of the acceleration to spin speed, and which might cause damage either to itself or adjacent objects, and is often alarming to the user. The user may then rearrange the articles in the drum with a view to achieving better distribution before again trying to spin.

It has also been suggested that instead of stopping rotation, a reversion to a tumble speed is effected in an attempt to achieve a better distribution of articles to be spun after which spinning is attempted again.

It has also been proposed to employ a speed control system for the motor driving the drum which, during the acceleration of the drum to the spin speed provides a slight pause in the rate of acceleration at what is called "distribute" speed to allow the contents of the drum to distribute themselves in a reasonably balanced formation inside the drum. The "distribute" speed is a speed above the normal "wash-tumble" speed and just below the "sticking" speed at which articles in the drum are held, by centrifugal force, against the inner surface of the drum and cannot move relatively to that surface. With such a control, it is found that in a high proportion of cases, spinning will take place with only a small out-of-balance although in a small proportion of cases relatively large out-of-balance loads will still persist, and the maximum spin speed has always to be limited so that on these occasions the forces created are kept within the limits that the machine can withstand.

In all the proposals just mentioned, the maximum spin speed is preset and is calculated, on the basis of the maximum out-of-balance load that will occur in practice even though this may happen very infrequently.

It is an object of the present invention to provide a washing machine with means that can operate more effectively to control spin speed during a spin sequence and may also be used to control other parts of a program.

According to the present invention, a washing machine includes water flow control means operable to control the admission of water to the machine, a driving motor for rotating the drum of the machine, a control system including weight responsive means, an arrangement for configuring the weight responsive means in a weighing mode or in an out-of-balance detection mode and a control system adapted to set the weight responsive means into a weighing mode to assess the weight of articles loaded into the drum and from the assessed weight to determine the weight of water to be admitted to the machine for washing the articles and to actuate the flow control means accordingly, and to set the weight responsive means to the out-of-balance mode at the commencement of a spin sequence to assess a speed speed suitable for spinning the articles and to set the motor to rotate at a speed appropriate to the assessed speed.

In one embodiment of the invention, the washing machine is adapted to tumble dry the articles at the termination of a washing program and in this case, the arrangement is also adapted to configure the weight responsive means into the load weighing mode at the end of the program and then to initiate a tumble dry sequence, and to determine the duration of the tumble dry sequence by comparing the assessed weight with the weight of the articles during the tumble dry sequence and to terminate the sequence when the weight of the articles bears a predetermined relationship with the assessed weight.

Preferably, the weight responsive means comprises transducers of an elastomeric silicon conductive rubber.

By way of example only, an embodiment of the invention comprising an automatic domestic washing machine with tumble dry facilities will now be described in greater detail with reference to the

accompanying drawings of which:-

Fig. 1 is a block schematic of the part of the control system of the washing machine,

Fig. 2 is a diagrammatic view partly in section of the washing machine.

Fig. 3 is a section on an enlarged scale of a part of the washing machine,

Fig. 4 is a horizontal section on the line IV-IV of Fig. 3,

Fig. 5 is a perspective view of the washing machine, and

Figs.6, 7 and 8 are scrap views of details of the machine shown in Fig. 5.

The automatic domestic washing machine is of generally conventional construction and is stepped through a user selected washing program by a control system including a microcomputer shown in Fig. 1 as block 1. Some of the programs include a tumble dry sequence and the microcomputer also controls the advancement of the machine through that sequence.

Selection of a required washing program is effected by operation of one of a set of push-buttons or touch sensitive switches shown at 2. Where the program includes a tumble dry sequence, operation of one or other of user controls indicated at 3 enables a user to select, from several preset degrees, the degree of dryness required.

Also inputting to the microcomputer is a load and imbalance detect circuit shown as block 4. The function of block 4 will be described in more detail later. Connected to the input side of the circuit are transducers 5, 6, further details of which are given below.

Control signals are transmitted from the microcomputer to various components of the washing machine to control the operation of those components. For example, signals on outputs 7 control the opening and closing of water valves which control the flow of cold and/or hot water into the machine. Other outputs 8, 9, 10 control respectively the operation of the lock on the machine loading door, a visual display showing for example, program selected, program time to run, dryness selection, and the water heater. Other outputs 11 control the energisation of the electric motor that turns the drum of the machine and the speed of rotation of the motor. Further outputs 12 control the operation of a fan and electric heater during tumble dry sequence.

A further output 13 from the microcomputer controls a warning device which may be audible or visible or both and which indicates to a user that the weight of articles loaded into the machine is too great for the program selected.

Also inputting to the microcomputer is a calibrate control 14 whose function will be described below.

It will be understood that, in practice, suitable interface circuits will be connected between the microcomputer and the several inputs and outputs therefrom shown in Fig. 1. Such interface circuits have been omitted from Fig. 1.

The transducers 5, 6 are of such form and are so located that they respond to the weight of a load of articles placed in the drum of the machine, to the weight of water in the tub of the machine and to the degree of any out-of-balance of the articles in the drum.

Preferably, the transducers 5, 6 are incorporated into the support system that supports the washing machine drums and tub assembly and the drive mechanism for the drum. An example of that location will be described below.

After the manufacture and assembly of the washing machine, the microcomputer is calibrated by energising the control system with the drum and tub completely empty or containing a small volume of water only. Under such conditions, the microcomputer will register the "empty" weight and will then, using the calibrate control 14, be "zero'd" at a weight slightly in excess of the "empty" weight to allow for conditions existing after the first use of the machine when, in many cases, a small quantity of water is retained in the tub. The slight excess represents the maximum weight of water that can be allowed to be retained in the tub at the commencement of a washing program.

The microprocessor may be programmed to allow a known weight to be added to the empty tub and the consequent "self-calibration" of the control system by the microcomputer.

The control system can thus be used to check, at the commencement of a wash program, that the weight of water retained in the tub does not exceed the maximum allowed weight. If it is found that the weight of retained water is greater than the allowed weight, the control system is adapted to take steps to cause the excess water to be pumped out of the machine.

Because the weight of water retained in the tub may vary somewhat, an accurate assessment is made, at the commencement of operations, of the actual weight of retained water and that assessment is used, when articles to be washed are loaded into the drum, by the microcomputer to assess the weight of the loaded articles.

The maximum permitted weight of articles depends upon the type of material that the articles to be washed are made from and whether the load is to be a "full" or a "half" load assuming that the control system is designed to provide such a facility. Selection of the "half" load option by a user allows the machine to draw in a preset volume of water that is smaller than that required for the

maximum permitted load.

It is customary, unless the "half" load option is selected, for the machine to take in a volume of water sufficient to wash a maximum permitted load.

In general, articles of synthetic material can be loaded to one half of the capacity allowed for articles made of cotton, and articles made of wool can be loaded to approximately one quarter of the capacity allowed for articles made of cotton.

The volume of water normally taken in for a full load of cottons is not necessarily the same as that drawn in for a full load of synthetic material or for wool, the latter normally requiring much more water in order to impart a more gentle washing action.

Thus, with the control system of Fig. 1, once the weight of articles loaded into the drum is known, the microcomputer will compute the correct weight of water needed for that weight and for the selected program and will monitor, via the transducers, the inflow of water to ensure that the correct weight is taken in.

In that manner, it is possible to avoid overloading or underloading the machine.

It will usually be required to allow the entry into the machine of a measured weight of water at the commencement of a program involving a "wash" sequence. Although such programs also include a "rinse" sequence, it is not essential to assess the weight of water to be drawn in at the commencement of each stage of a "rinse" sequence because it can be assumed that the weight of "rinse" water bears a fixed relationship to the weight of water taken into the machine for the "wash" sequence. Each "rinse" stage may require the same weight of water as the "wash" sequence or a proportion of that weight.

Alternatively, where a small load is to be dealt with, the control system may be adapted to reduce the number of "rinse" stages in the rinse sequence, or it is sometimes arranged that all rinses are carried out with a preset maximum weight of water in order to achieve the best rinse possible irrespective of the weight of the load or the type of material of the articles.

Thus, the transducers and the control system will require, in most cases, the calculation of the required weight of water only at the initial stage of a wash sequence. During the "rinse" sequence, an already calculated weight of water would be used to control the inflow of "rinse" water.

For some programs, the washing machine will draw in both hot and cold water and, in those cases, the control system preferably incorporates means for sensing the temperature of water in the tub of the machine and, for regulating the inputs of hot and cold water according to the sensed temperature. The microcomputer is programmed to allow the inflows of hot and cold water to provide the required weight of water at the required temperature.

In order to be accurate, weighing of incoming water must be effected when the drum is stationary, i.e. not rotating, and as water in the tub has to be agitated to mix incoming hot and cold supplies to ensure a homegeneous mix for temperature sensing, incoming water is taken first from one supply and then from the other depending upon the sensed temperature, the drum being slowly rotated briefly after each intake. The sequencing of the temperature sensing means, the valves controlling the inflow of hot and cold water and the monitoring of the weight of water is determined by the control system. It is preferable to effect weight measurments in the intervals between the inflow of water and when the drum is stationary.

Once the washing of the articles has been completed, the drum will be "spun" to remove a proportion of the water retained in the articles. As has been explained above, the higher the spin speed the greater the proportion of water that can be removed. In many conventional washing machines, the maximum spin speed is usually preset to a value that will not result in undesirable movement of the drum and machine if spinning of an out-of-balance load takes load. The maximum spin speed in such machines is calculated on the basis of the maximum out-of-balance that will occur in practice even though that degree of out-of-balance may occur very infrequently.

In the control system of Fig. 1, transducers 5 and 6 respond to the degree of out-of-balance of the load and this information is fed to the microcomputer which selects a spin speed suitable for that degree. The transducers 5 and 6 are able to respond to the degree of imbalance as spinning proceeds so that as water is removed from the articles and the degree of out-of-balance reduces, the spin speed will be increased by the microcomputer. In that way, it is possible to achieve the maximum spin speed and extract the greatest proportion of water from the articles.

In some cases, the machine is cycled through a spin sequence which may comprise a first spin stage at a relatively low preset spin speed followed by a second spin stage at a somewhat higher preset speed. There is then a third spin stage at a speed determined by the detected degree of out-of-balance. In this case, the microprocessor may be programmed to bring the transducers into the out-of-balance detection mode at the end of the second spin.

Alternatively, the microprocessor may be programmed to bring the transducers into operation at the end of the wash sequence and before any spinning takes place. In this case, sensing of out-of-balance may occur before each spin stage.

Sensing of the degree of out-of-balance may take place continuously through one or more of the spin stages so that, if necessary, a continuous adjustment of spin speed is possible.

Some wash programs incorporate a tumble dry sequence. At the end of the wash sequence of such programs, the microcomputer will record the "damp" weight of articles in the drum at the conclusion of the "spin" and will then initiate the tumble dry sequence. As moisture is evaporated from the articles by the circulation of heated air therethrough, the weight of the articles reduces. That reduction is sensed by the transducers 5, 6 and is used to terminate the tumble dry sequence when a reduction has been reached that is consistent with the degree of dryness selected by the user before the commencement of the program.

Fig. 2 shows, in schematic form and partly in section, a washing machine embodying the invention.

The machine has a tub 15 inside which is a cylindrical washing drum 16 rotatable about a horizontal axis by an electric driving motor 17 suspended beneath the tub 15 by links 18. The output shaft of the motor 17 is coupled to the drum 16 by pulleys and driving belts not shown.

Washing powder and fabric conditioner are supplied to the drum via a feed tube 19 from the conventional pull-out drawer indicated at 20. A water heater element is also located inside the tube as indicated at 20A.

The components just referred to are located within an external casing 21, the base 21A of which is designed to receive and support resilient struts 22, 23 which extend upwardly from the base and between them support the tub 1. The struts are located one on each side of the tub 1 and are inclined inwardly slightly. Only one strut is shown in detail in Fig. 2 and it comprises a piston-cylinder assembly 24. The upper end of the piston is secured to a bracket 25 on the tub 15 by means of a resilient mounting block 26. The lower end of the cylinder is secured to the base by resilient mounting blocks 27, 28.

Figs. 3 and 4 show, on an enlarged scale, the mounting of the lower end of the cylinder. The cylinder has an end cap 29 from which extends a bolt 30 that passes through upper and lower compression plates 31, 32, the base 21A and the mounting blocks 27, 28 which, it will be observed, are located one above and one below the base 21A. A nut 33 screwed over the lower, threaded end of bolt 30 enables the blocks 27, 28 to be prestressed to a required degree.

Moulded into the upper mounting block 27 is a part annular insert 34 of an elastomeric silicon conductive rubber whose open ends are bonded to conductors 35, 36 which electrically connect the insert to the load detect circuit 4 shown in Fig. 1.

The conductive rubber, of which the inserts 34 are made, has an electrical resistivity that changes with the degree of compression of the insert and this change is utilised to carry out the weighing operations and out-of-balance detection referred to above.

The load detect circuit 4 has a facility which allows the inserts 34 to be series connected for the purpose of carrying out the weighing operation or allows the inserts 34 to input separately to the circuit for the purpose of out-of-balance detection.

The series connection of the inserts 34 ensures an accurate indication of weight irrespective of the distribution of the load weight between the struts. This is important in the case of a load of articles within the drum and which may be irregularly distributed therein. The load may be centred to one side or the other of the vertical plane through the longitudinal axis of the drum and/or nearer the front or the back of the drum. In each case, the aggregated values of the conductivity of the inserts provide an accurate indication of the weight of the articles and the load detect circuit 4 inputs a signal representative of that weight to the microcomputer.

When used in the out-of-balance detection mode, each insert inputs separately to the load detect circuit 4 where the inputs are compared to obtain an indication of the degree of out-of-balance. An out-of-balance condition of the load tends to produce cyclic increases and decreases in the degree of compression of the inserts with consequential changes in the electrical conductivity thereof.

Thus, in a typical program involving wash, rinse, spin and tumble dry, the sequence of events will be as follows:

First, the machine is switched on by the user. A check is then made by the control system to ensure that the machine is ready for use. If the "zero'd" weight is not registered, that fact will be indicated to the user by a suitable signal and a program "start" control is disabled. The 'zero'd' weight will not be registered if, for example, an excess volume of water has been retained in the machine, or, if a load of articles has been left in the machine. If the weight of retained water is greater than the acceptable weight then the microcomputer energises the machine water pump and the excess is pumped away. If the sensed weight is in excess of the acceptable weight because articles have been left in the drum, the indication will remain as will the disablement of the start control. In such circumstances, the user is instructed to check that the drum is empty or to remove the contents thereof. If the weight is then "acceptable", the microcomputer indicates to the user that loading of articles to be washed can commence and that the

desired washing program can also be selected.

At the same time, the load detect circuit, under the control of the microcomputer connects the inserts into the series, load sensing configuration and load sensing commences. If the weight of loaded articles exceeds the maximum permitted weight for the selected program, the microcomputer causes energisation of the warning, and articles are then removed until the maximum permitted weight is achieved, that weight being stored in the microcomputer.

In the alternative, the weight of loaded articles may not reach the maximum permitted weight. In that case also, the weight of the loaded articles is stored in the microcomputer.

The loading door is then closed and the "start" control is operated.

The microcomputer will then cause the water flow control valve or valves to open and admit water into the tub and will also maintain the inserts in the load sensing configuration to monitor the weight of incoming water. When that weight reaches a value appropriate to the maximum permitted load weight or a value assessed by the microcomputer to be appropriate to the loaded weight of articles if less than the maximum permitted weight, the inflow of water is stopped and the washing sequence initiated by the microcomputer.

The microcomputer may also signal the display to show the stage in the program reached and/or the time to run to the end of the program.

At the end of the rinse stages, the microcomputer will cause the inserts to switch to the out-of-balance sensing configuration and an initial check is made on the degree of out-of-balance of the load. That information is signalled to the microcomputer which determines an acceptable spin speed for that degree of out-of-balance and the spin stages commence. The microcomputer continues to monitor the degree of out-of-balance and when this reduces as water is extracted from the articles the spin speed is increased by a calculated amount.

That monitoring continues until the end of the spin stages is reached.

The machine then enters the tumble dry stage and the fan and air heater are energised and the inserts revert to the load sensing. On the basis of the stored dry load weight, the microcomputer assesses the weight that the load will have at the user selected degree of dryness and monitors the reducing load weight. When the assessed load weight is reduced, the microcomputer terminates the tumble dry stage and energises the display to show that the program has finished. The retained weights are erased from the microcomputer memory and the control system is returned to its initial state ready for another program.

It will be appreciated that the transducers 5, 6 may occupy sites other than those shown in Fig. 2 and described above. They may, for example, be located in the upper mounting blocks 26, or at some point in a resilient suspension system if such is used to suspend the tub.

The microcomputer may provide facilities additional to those described above. For example, it may be programmed to cause the display to show the weight of detergent required for a particular program and the weight of articles loaded for that program. Similarly, with fabric softener.

The transducers may also be of other materials than that described above. For example, the transducers may be conventional load cells incorporating piezo-electric or other load sensitive material. They could also be liquid filled containers, the liquid pressure in which is determined by the weight to be sensed.

The washing machine may be provided with additional weighing facilities. For example, the slot-in washing machine 37 shown in Fig. 5, housed adjacent a kitchen cabinet 38, has a cover which is flush with the adjacent top surface of cabinet 38 and which is mounted upon transducers which may be of elastomeric silicon conductive rubber.

The cover may be mounted upon four such transducers located beneath the four corners of the cover. The locations are indicated at 39 in Fig 1. Beneath the cover, the body of the washing machine has a supporting rail 40 which supports four resilient pads 41 each of which has a gapped annulus 42 moulded into it. The ends of each annulus are joined by conductors 43 in series configuration to the load detect circuit 4 shown in Fig. 1.

The transducers 42 are additional to those in the struts 22, 23 referred to above. By the actuation of suitable controls on the fascia panel 44 of the washing machine, the microcomputer is controlled to assess the weight of articles placed on the cover and to cause the display to indicate the weight.

The articles may be clothes to be washed and in this case actuation of a further control will cause the weight to be stored in the microcomputer for use in a washing program as described above.

The cover may be used as electronic kitchen scales and a zero button may be provided to allow a user to reset the display to zero, for example when an empty container has been placed on them, and thereby to weigh material added to the empty container after "zeroing".

Claims

1. A washing machine including a tub, a drum supported by the tub for rotation therein, a driving motor for rotating the drum, weight responsive means responsive to the weight of the contents of the drum and adaptable to respond to the degree of out-of-balance of the drum contents, and a control system for controlling the speed of rotation of the motor during a spin sequence in accordance with the degree of out-of-balance sensed by the weight responsive means.

2. A washing machine including a tub, a drum supported by the tub for rotation therein, water flow control means operable to control the admission of water to the machine, a driving motor for rotating the drum, a control system including weight responsive means, an arrangement for configuring the weight responsive means into a weighing mode and into an out-of-balance detection mode, and a control system adapted to cause the arrangement to configure the load responsive means into a weighing mode to assess the weight of articles loaded into the drum and from the assessed weight to determine the weight of water to be admitted to the machine at the commencement of a wash sequence, and to cause the arrangement to configure the load responsive means into the out-of-balance mode prior to the commencement of a spin sequence or at a suitable point during that sequence to assess the degree of out-of-balance of articles in the drum and from the assessed degree of out-of-balance to determine the maximum speed of rotation of the drum.

3. A washing machine as claimed in claim 1 or 2 in which the arrangement is such that the weight responsive means senses the degree of out-of-balance through a spin sequence, the control system operating to adjust the motor speed in accordance with sensed degree of out-of-balance.

4. A washing machine as claimed in claim 1, 2 or 3 in which the tub is supported by resilient supports which incorporate the weight responsive means.

5. A washing machine as claimed in claim 1, 2, 3 or 4 in which the tub is supported upon resilient struts connected between the tub and the base of the washing machine.

6. A washing machine as claimed in claim 5 in which each strut is connected to the tub and/or the base via a resilient mounting and the weight responsive means are incorporated in the resilient mounting.

7. A washing machine as claimed in any one of the preceding claims in which means are provided to enable the machine to "tumble dry" the articles at the end of a wash program, and in which the arrangement is also adapted to configure the weight responsive means into the load weighing mode at the end of the program and then to initiate a tumble dry sequence, and to determine the duration of the tumble dry sequence by comparing the assessed weight with the weight of the articles during the tumble dry sequence and to terminate the sequence when the weight of the articles bears a predetermined relationship with the assessed weight.

8. A washing machine as claimed in any one of the preceding claims which has a cover supported upon the machine by load sensitive means and in which the control system is adapted to be set to display the weight of an article or articles placed on the cover.

9. A washing machine as claimed in claim 8 in which the control system includes means permitting the entry into the system of the displayed weight and to use the entered weight to determine the weight of water to be admitted to the machine at the commencement of a wash sequence.

10. A washing machine as claimed in claim 8 or 9 in which the load sensitive means comprise transducers of an elastomeric silicon-conductive rubber.

11. A washing machine as claimed in any one of the preceding claims in which the weight responsive means comprise transducers of an elastomeric silicon-conductive rubber.

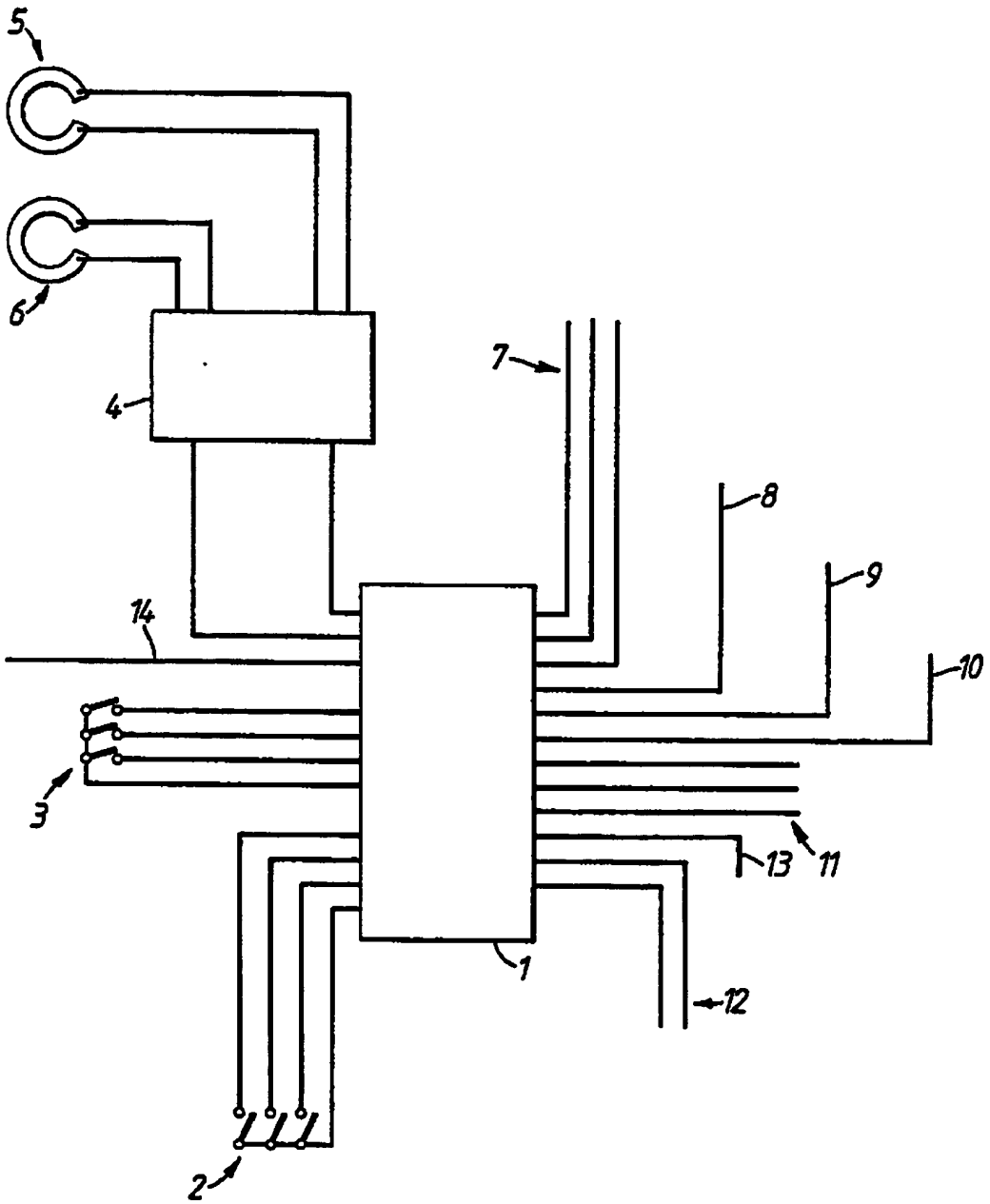

FIG. 1.

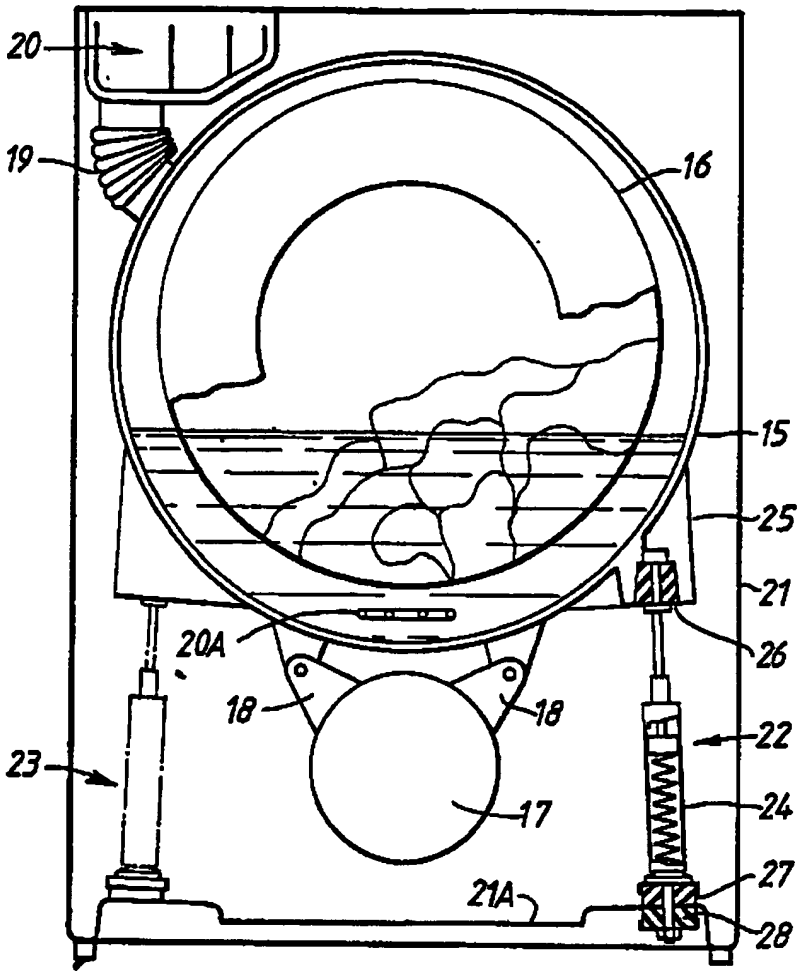

FIG.2.

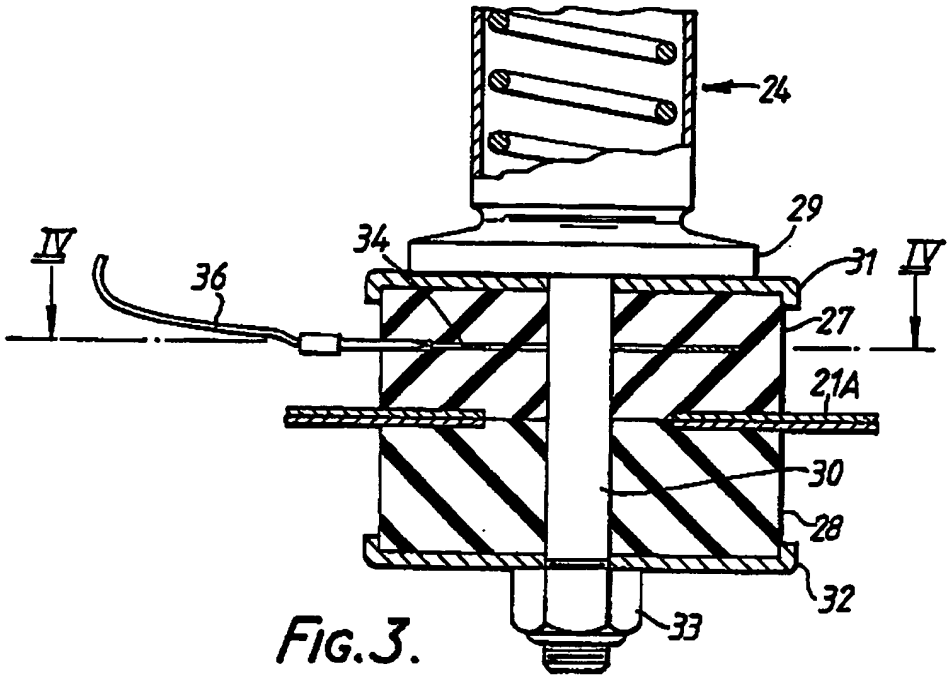

FIG.3.

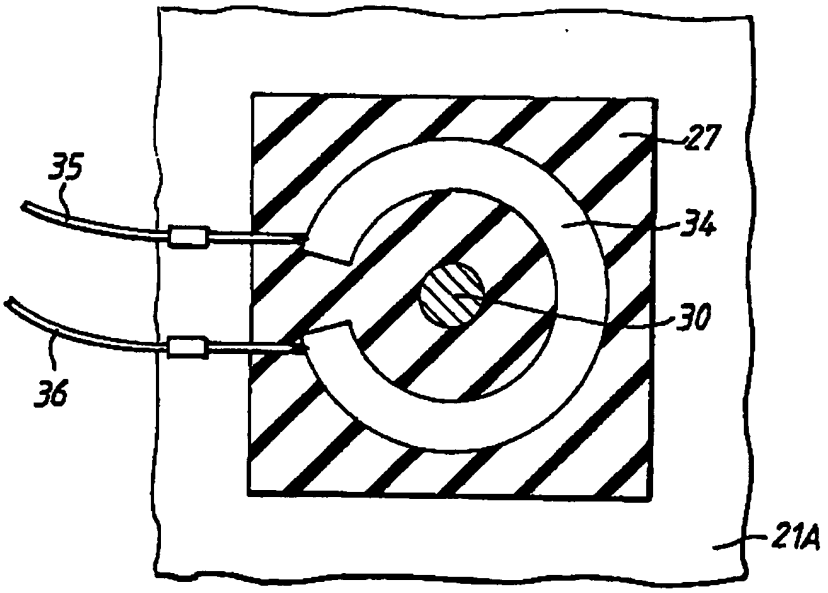

FIG.4.

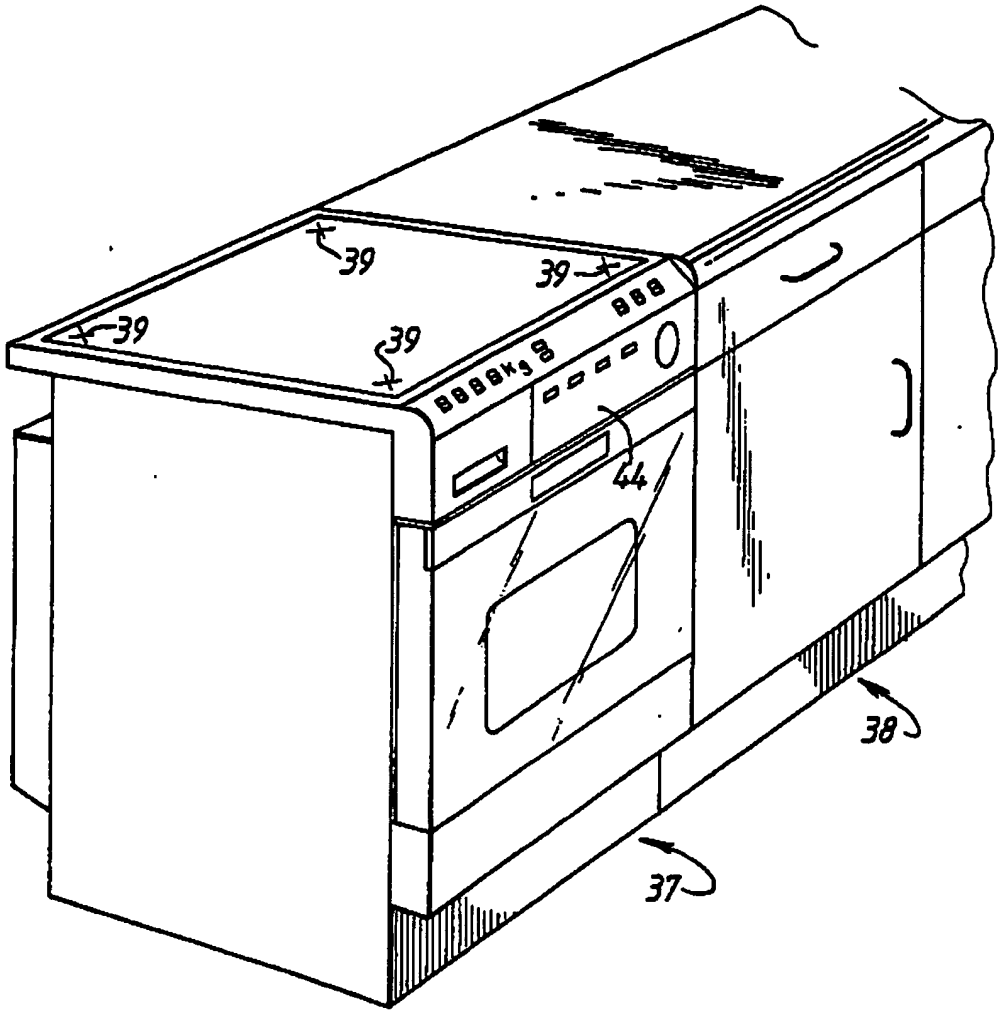

FIG.5.

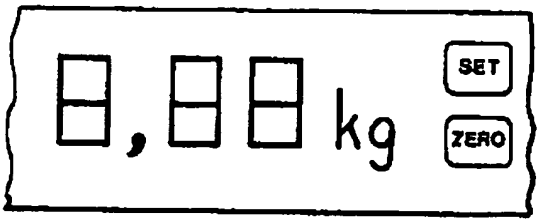

FIG8.

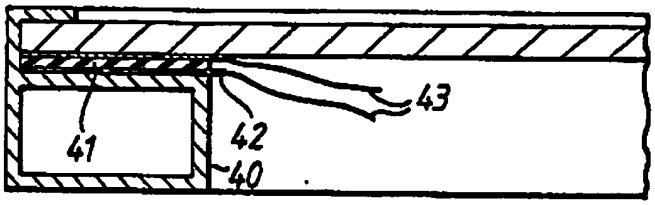

FIG. 6.

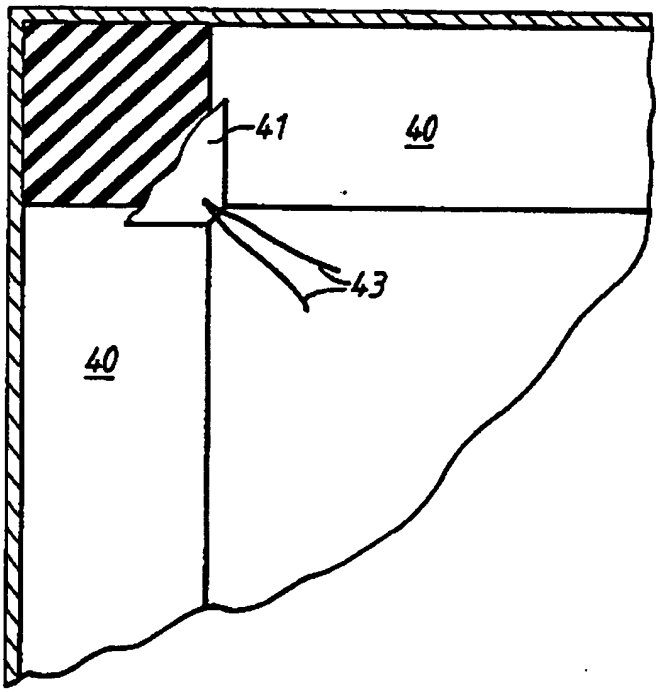

FIG. 7.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 1873

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	CH-A- 651 602 (TERRAILLON) . * The whole document *	1,2,4-6	D 06 F 37/20 D 06 F 39/00
A		3	
A	DE-A-2 844 755 (BAUKNECHT) * The whole document *	1-6	
A	DE-A-3 413 967 (VDO ADOLF SCHINDLING) * Figure; claims *	8-11	
A	GB-A-2 174 513 (HOOVER) * Figure 5; abstract *	3	
A	FR-A-2 585 833 (P.GERBAUD) * Figure 1; abstract *	7	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D 06 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-05-1988	COURRIER, G.L.A.

CATEGORY OF CITED DOCUMENTS

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Application Number

EP 88 30 1873

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	CH-A- 651 602 (TERRAILLON) * The whole document *	1,2,4-6	D 06 F 37/20 D 06 F 39/00
A	---	3	
A	DE-A-2 844 755 (BAUKNECHT) * The whole document *	1-6	
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A	DE-A-3 413 967 (VDO ADOLF SCHINDLING) * Figure; claims *	8-11	
A	---		
A	GB-A-2 174 513 (HOOVER) * Figure 5; abstract *	3	
A	---		
A	FR-A-2 585 833 (P.GERBAUD) * Figure 1; abstract *	7	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D 06 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-05-1988	COURRIER, G.L.A.

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